Aluminum Integrated Minimill (AIM)

August 24 – 25, 2016

Detroit, MI

METALS Annual Meeting

Agenda

ERCo ENERGY RESEARCH COMPANY

- Team Intro
- Technical Concept
  - Aluminum Integrated Minimill (AIM)
  - Laser induced Breakdown Spectroscopy (LIBS)
  - Vertical Floatation Decoater (VFD)
- Technical Progress to date
- TEA Highlights
- Demo Requirements
- Future Goals/Closing Thoughts
- Q&A

Team Intro (ERCo)

ERCo ENERGY RESEARCH COMPANY

Small High Tech Company
Plainfield, NJ
Operating Since 1991
Laser Instrumentation
Furnace and Heat Exchanger Development
Industry Expert

Robert De Saro, President, PI; VFD, LIBS Technology
Joe Craparo, Senior Engineer, LIBS Field Testing
Arel Weisberg, Vice President, LIBS Calibration Free Specialist

Goals:
Demonstrate AIM
Continue Commercializing LIBS

<u>Project Summary</u>

- AIM is Transformational
- Will Reduce Process Energy by 94%
- Will Save 32.9 Trillion kJ/yr
- LIBS Technology Development Targets Exceeded
- Successfully Commercialized LIBS Leading to a Potentially Thriving Business
- VFD Design Completed and Vendors Selected
- Assembled a World Class Team to Both Develop and Commercialize the Technologies
- And Have Been Successful Keeping All the Project's Moving Parts Synchronized

Team

ERCo ENERGY RESEARCH COMPANY

- ERCo
- Executive Team
  - ERCo
  - wTe
  - MS LLC
- Hatch
- wTe
- MS LLC

Team Intro (ERCo)

ERCo ENERGY RESEARCH COMPANY

- **Advisory Board**
  - Dan Twarog (Chair) – North American Die Casting Association
  - Dave Weiss – Eck Industries
  - Georg Rambach – Hydro Aluminum Rolled Products
  - Tom Prucha – American Foundry Association
  - Rod Riek – Harley Davidson

AIM Technical Concept

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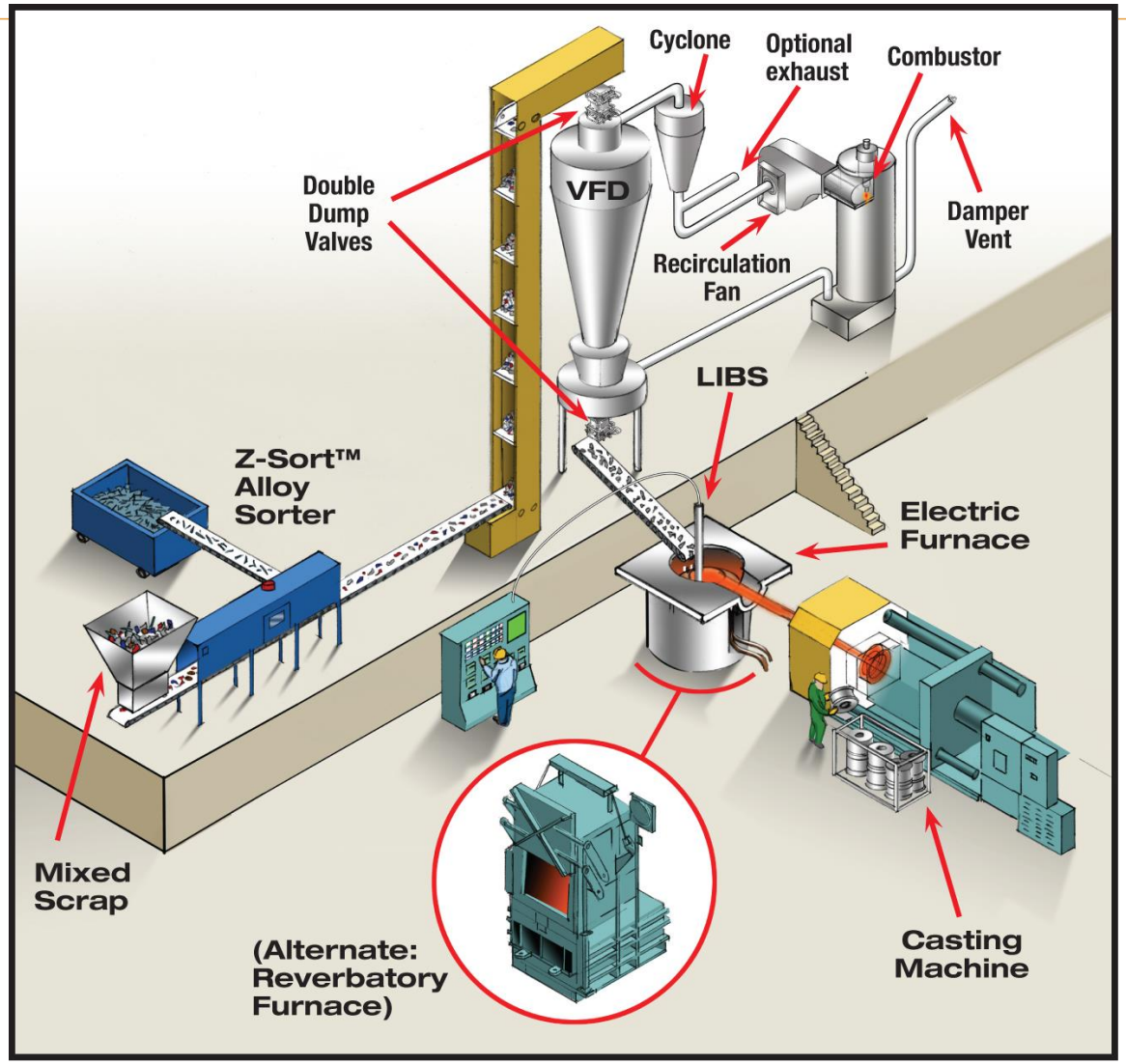

AIM Technical Progress to Date

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- Components Being Developed
- Integration Engineering Completed
- AIM Virtual Integrated Testing Pending

AIM TEA Highlights

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- Advantages Compared to Conventional Scrap Aluminum Processing:
  - Eliminated A Melting Step
  - Uses 100% Scrap and Eliminates Need for Costly Primary Metal
  - Component Thermal Efficiencies Improved
- Which Leads to:
  - Reduce Energy Use by 94%
  - Reduce Energy by 32.9 Trillion kJ/year
  - Reduce CO_2 by 1.3 Million Tonnes/year
  - Retain 1 Million Tonnes/year of Al Scrap in US
- Scale at 4,000 lbm/hr for Mercury Marine
- Other Scales Possible Depending on Customer Needs
- Market Understood and Developed
- AIM Economic Model Competed

LIBS Technical Concept

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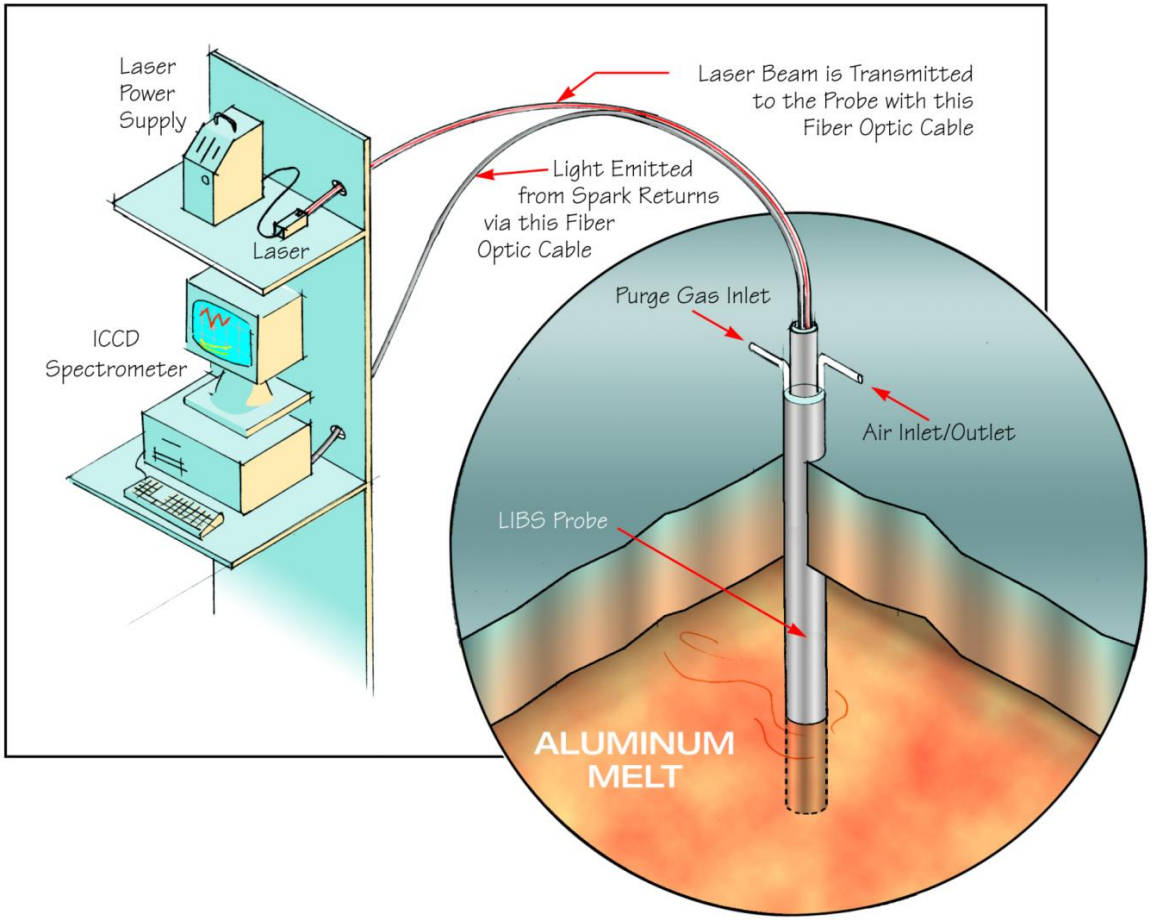

Technical Progress to Date

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- Completed Three Design Iterations
- LIBS Fielded Tested Multiple Times
  - Mercury Marine
  - Palmer Die Casting
  - WPI
- LIBS Targets Exceeded
  - Fully Developed Commercial Ready Instrument for Bulk Chemistry
  - Close to Commercial Ready for Inclusions and Hydrogen
  - Measured Diffusion/Dissolution Times in a Furnace

LIBS TEA Highlights

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- Can Reduce Operational Time Leading to Reduced Energy and increased Production
- Already Changed One Industrial Operation
- LIBS Sales To Date
  - Service Contracts $82,836
  - Products Sold $60,000
  - Total **$142,836**
  - Product Sale Pending $750,000
  - Total **$892,836**

VFD Technical Concept

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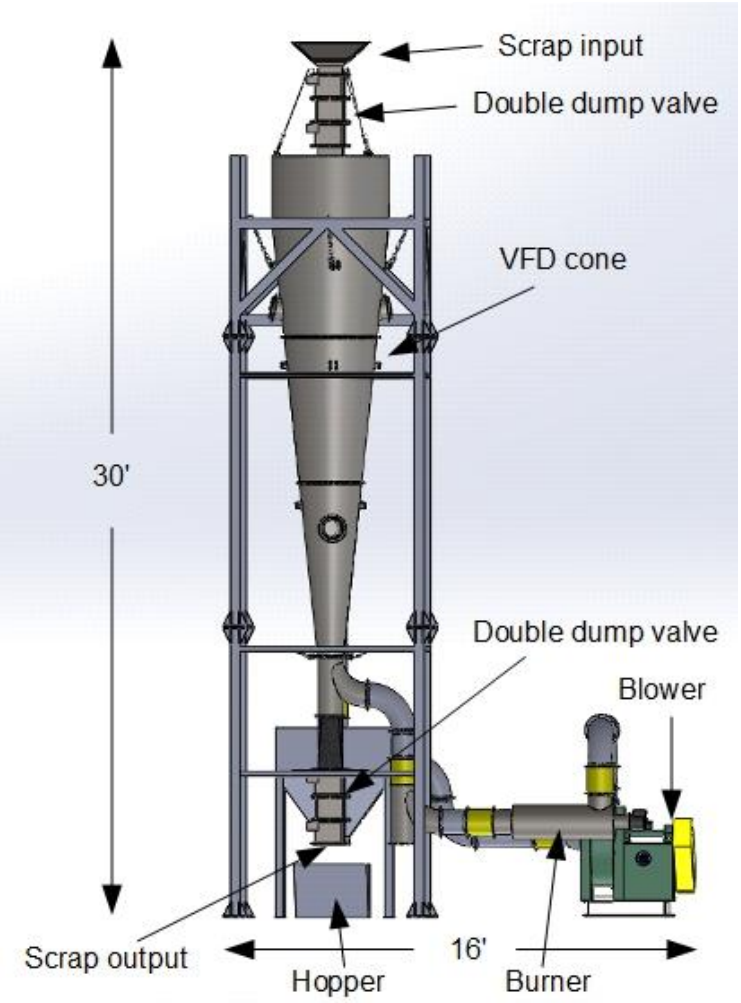

VFD Technical Progress to Date

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- Mathematical Model Completed
- Performance Predictions Completed
- Final Design Completed
- All Components Specified
- All Vendors Selected
- Scaled Cold Flow Testing Completed
- Pilot System Ready to Be Built

Future Plans

- AIM Demo with VFD and Sorter (Part of Existing ARPA-E Project)
- AIM Pilot Installation
- Complete LIBS Inclusion and Hydrogen Measurement Technical Development
- Lay Groundwork for AIM Pilot Installation
- Continue Aggressive Marketing for LIBS

Demo Requirements

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- Current Project, Virtual Demonstration
- In Next Phase, Full-Scale AIM Pilot Plant at 4,000 pph (Starting in 2nd Q 2018)
- Have Host Site Partner And Seeking Others
- Funding for Pilot Plant
  - Federal, VC, Partners

Future Goals/Closing Thoughts

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- I want to reinvent the Al industry
- LIBS is already doing that but to a lesser degree than AIM will
- I want to keep scrap Al In USA and I want to drastically reduce energy use and greenhouse gas emissions. AIM will do that.
- Oh, and did I mention I want to make a wildly financially successful company
- To do so, we must be technically successful
- BUT……
- Need to be commercially successful If the technical success is to be meaningful